JC803 U.S. PTO

Express Mail Label No. 06/07/00

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
F-10190

Total Pages in this Submission

JC829 U.S. PTO
09/588725
06/07/00

TO THE ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

TASK PROCESSING SYSTEM

and invented by:

Shusaku Uchibori

If a CONTINUATION APPLICATION, *check appropriate box and supply the requisite information:*

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 10 pages and including the following:
   a. ☒ Descriptive Title of the Invention
   b. ☐ Cross References to Related Applications *(if applicable)*
   c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
   d. ☐ Reference to Microfiche Appendix *(if applicable)*
   e. ☒ Background of the Invention
   f. ☒ Brief Summary of the Invention
   g. ☒ Brief Description of the Drawings *(if drawings filed)*
   h. ☒ Detailed Description
   i. ☒ Claim(s) as Classified Below
   j. ☒ Abstract of the Disclosure

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Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
   a. ☒ Formal Number of Sheets **5 (Figs. 1-5)**
   b. ☐ Informal Number of Sheets _____
4. ☒ Oath or Declaration
   a. ☒ Newly executed *(original or copy)* ☐ Unexecuted
   b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
   c. ☒ With Power of Attorney ☐ Without Power of Attorney
   d. ☐ *DELETION OF INVENTOR(S)*
   Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
   The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ Computer Program in Microfiche *(Appendix)*
7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
   a. ☐ Paper Copy
   b. ☐ Computer Readable Copy *(identical to computer copy)*
   c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☒ Assignment Papers *(cover sheet & document(s))*
9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*
10. ☐ English Translation Document *(if applicable)*
11. ☒ Information Disclosure Statement/PTO-1449 ☒ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Acknowledgment postcard
14. ☐ Certificate of Mailing
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Docket No. F-10190
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Accompanying Application Parts (Continued)

15. ☒ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

16. ☐ Additional Enclosures *(please identify below):*

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra		Rate	Fee
Total Claims	4	- 20 =	0	x	$18.00	$0.00
Indep. Claims	1	- 3 =	0	x	$78.00	$0.00
Multiple Dependent Claims (check if applicable) ☐						$0.00
					BASIC FEE	$690.00
OTHER FEE *(specify purpose)* Assignment recordation						$40.00
					TOTAL FILING FEE	$730.00

☒ A check in the amount of **$730.00** to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **50-0481** as described below. A duplicate copy of this sheet is enclosed.

- ☐ Charge the amount of as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Signature

Dated: **June 7, 2000**

Sean M. McGinn, Esq.
Registration No. 34,386

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Customer No. 21254

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APPLICATION FOR UNITED STATES LETTERS PATENT

APPLICANT: Shusaku Uchibori

FOR: TASK PROCESSING SYSTEM

DOCKET NO.: F-10190

TASK PROCESSING SYSTEM

BACKGROUND OF THE INVENTION

1. Technical Field of the Invention

The present invention relates to a task processing system, and particularly, to a task processing system for speeding up task processing by controlling generation of overhead for task switching in the case of processing a large number of small sized- tasks.

2. Description of the Prior Art

In a conventional task processing system, when the tasks to be processed are known in advance, the task processing speed of the system is optimized by scheduling the tasks beforehand. On the other hand, when it is impossible to schedule the tasks, the tasks are processed as asynchronous events such as interrupts. For example, in the "Queue Processing Method" as disclosed in JP10-326197 A (1998), ordinary events from software and interrupt events caused by a timer or hardware interrupt are accepted at any time, and are registered into an input key. Then, they are executed sequentially without prohibiting interrupt.

As shown in Fig. 5, in the above-mentioned "Queue Processing Method", the queue entries of ordinary events and interrupt events are prepared. When interrupt 1 event occurs, its content is stored in interrupt 1 event information block, and its event queue is added to the interrupt 1 event queue. Interrupt 2 event is processed in the same way. The data stored in the interrupt 1 event information block and the

interrupt 2 event information block is registered again as the ordinary event, by releasing the registration of the interrupt event queue without transferring it to the ordinary event information block.

However, the above-mentioned conventional task processing system has a disadvantage that it cannot improve the speed of the task processing of the whole system, because it is impossible to schedule the tasks beforehand. Therefore, it becomes necessary to generate overheads for acquiring and releasing the resources necessary for the task processing.

The conventional task processing system has another disadvantage that it is not suitable for processing a large number of small-sized tasks, because a lot of overheads for task switching becomes necessary.

SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to speed up the task processing by controlling the overhead generation for task switching in the case of processing a large number of small-sized tasks.

The task processing system of the present invention comprises a storage means for storing an identifier of a generated event, a task control device for creating a task based on the above event, and a task processing device for processing the task. The task processing device searches the identifier for creating the same task as the processed task, so as to further process the same task as the processed task.

The task processing system of the present invention

processes a task depending on the kind of a created event. Concretely, it checks whether or not an event of the same kind occurred, after completion of the task processing. When an event of the same kind has occurred, the same task is continuously processed. Therefore, the overhead for acquiring and releasing resources necessary for the task processing is reduced, thereby speeding up the task processing on the whole system.

According to the present invention, it is possible to speed up the task processing in the whole system, because the overheads for acquiring and releasing a resource necessary for the task processing are reduced.

Further, according to the present invention, it is possible to process a large number of small-sized tasks at higher speed, because the tasks are switched at higher speed, due to the overhead reduction.

BRIEF EXPLANATION OF THE DRAWINGS

Fig. 1 is a block diagram of the task processing system of the first embodiment of the present invention.

Fig. 2 is a flow chart for describing the operation of the task processing system as shown in Fig. 1.

Fig. 3 is a block diagram of the task processing system of the second embodiment of the present invention.

Fig. 4 is a flow chart for describing the operation of the task processing system as shown in Fig. 3.

Fig. 5 is a sequence diagram for explaining a conventional queue processing method.

PREFERRED EMBODIMENT OF THE INVENTION

A block diagram of the task processing system of the present invention is shown in Fig.1. The task processing system as shown in Fig.1 comprises event creating device 1 such as an interrupt creating device, storage means 2 for storing information, task processing device 4 operated by a program control, and task control device 3 for controlling task processing device 4, depending on the created event.

Storage means 2 comprises event storing unit 21 for storing the events created by event creating device 1, and task resource storing unit 22 for storing the resources necessary for the task processing of programs and data. An event stored in event storing unit 21 includes event identifier 211 for identifying the kind of the event.

Task control device 3 comprises event check means 31, task creating means 32, and task resource management means 33.

When task processing device 4 completes the task processing, event check means 31 checks whether the event for creating the same task as the completed task is registered in the event storing unit 21. Event identifier 211 is used for the check.

Task creating means 32 controls task processing device 4 so as to activate a task corresponding to the event registered in event storing unit 21. Event identifier 211 identifies the corresponding task.

Task resource management means 33 acquires a resource at the time of starting the task, and releases the resource at the time of completing the task.

The task corresponding to the event registered in event storing unit 21 is created by task creating means 32, and processed by task processing device 4. The resource necessary for the task processing is read out from task resource storing unit 22 by task resource management means 33, and supplied to the task processing device 4. Thus, the necessary resource is acquired.

At the time when the task processing has been completed in task processing device 4, event check means 31 checks whether an event of the same kind as that of the event having created the completed task is registered in event storing unit 21. When it is not registered, a resource required to be rewritten to the task resource storing unit 22, among the resources required by the completed task, is returned back to task resource storing unit 22, through the task resource management means 33. Thus, the resource is released.

When an event of the other kinds is registered in event storing unit 21, the task creation and resource acquisition are repeated. When an event of the same kind as that of the event having created the completed task is registered in event storing unit 21, the same task is continuously processed by task processing device 4 without releasing the resource.

Thus, sequential execution of the same task helps to reduce the overhead for the release and acquisition of resources, when various tasks are processed, thereby speeding up the task processing on the whole system.

Fig. 2 is a flow chart for describing the operation of the task processing system of the present invention. An event created by event creating device 1 is stored in event storing unit 21.

Event identifier 211 indicating the kind of the event is also stored in event storing unit 21.

Event check means 31 checks whether an event having a specified identifier is stored in event storing unit 21 (Steps A1 and A2).

When the event having the specified identifier is stored, task resource management means 33 reads out a resource necessary for the task corresponding to event identifier 211 from task resource storing unit 22 and feeds the read out resource to the task processing device 4 (Step A3).

Further, task creating means 32 activates or creates a task corresponding to event identifier 211, by using task processing device 4, while the corresponding event is deleted from event storing unit 21 (Step A4).

Event check means 31 checks whether an event having the same identifier as event identifier 211 corresponding to the completed task is stored in event storing unit 21 (Steps A5 and A6).

When an event having the same identifier is stored, the step returns to Step A4, where the same task as the completed task is created by task creating means 32, and the corresponding event is deleted from event storing unit 21.

Finally, when an event having the same identifier is not stored, task resource management means 33 rewrites, into task resource storing unit 22, the resource which has been used by the completed task and should be released (Step A7).

A block diagram of another embodiment of the task processing system of the present invention is shown in Fig.3. The embodiment as shown in Fig. 3 is different from the

embodiment as shown in Fig. 1 in that a plurality of task processing devices 41, 42, 4N are provided, in place of task processing device 4, and further in that storage means further comprises executing task storing unit 23.

Executing task storing unit 23 stores each task which is being executed by task processing devices 41 to 4N. The task stored by executing task storing unit 23 also includes event identifier 231 for identifying the kind of the task.

A flow chart for explaining the operation of the task processing system as shown in Fig. 3 is shown in Fig.4. The flow charts are identical, and operating in parallel for the number N of task processing devices.

The operations of event check means 31, task creating means 32, and task resource management means 33 in this embodiment as shown from Step B31 to Step B61 in Fig. 4 are the same as those of respective means 31, 32, and 33 in the embodiment shown in Fig. 1.

The event created by event creating device 1 is stored in event storing unit 21. Event identifier 211 indicating the kind of the event is also stored in event storing unit 21.

Event check means 31 checks whether any other event having an identifier other than event identifier 231 of the task stored in executing task storing unit 23 is stored in event storing unit 21 (Steps B11 and B21).

In Step B41, task creating means 32 activates or creates a task corresponding to event identifier 211, by using task processing device 4, while the corresponding event is deleted from event storing unit 21 and simultaneously stored in executing task storing unit 23.

Finally, when no event having the same identifier is stored, in Step B71, task resource management means 33 rewrites, into task resource storing unit 22, a resource which have been used by the completed task and should be released. The corresponding task is deleted from the executing task storing unit 23.

What is claimed is:

1. A task processing system which comprises:

a storage means for storing an identifier of a created event;

a task control device for creating a task based on said created event; and

a task processing device for executing said task,

wherein said task processing device executes a search for said identifier for creating the same task as the task which has been completed; and further processes said same task.

2. The task processing system according to Claim 1, wherein a part or all of resources used by said task which has been completed is or are released toward said storage means, when no identifier for creating said same task as said task which has been completed is found as a result of said search.

3. The task processing system according to Claim 2, wherein said resources are deleted from said storage means, when said resources are transferred from said storage means via said task control device to said task processing device.

4. The task processing system according to Claim 1, wherein:

said storage means stores an identifier of said task which is being executed by said task processing device; and

said task control device executes a search for said identifier for creating the same task as said task which is being executed, and executes said same task, after completeting said task which is being executed.

ABSTRACT

To improve the task processing speed, when a large number of small-sized tasks are executed. When a task is completed, the event check means checks whether or not an event of the same kind as that of the event which created the completed task is registered in the event storing unit. When it is not registered, the resources which have been used by the completed task and should be rewritten are returned from the task resource management means to the task resource storing unit. When an event of the other kinds is registered in the event storing unit, the task creation and resource acquisition are repeated. When an event of the same kind is registered, the same task is continuously processed without release and re-acquisition of resource.

FIG.1

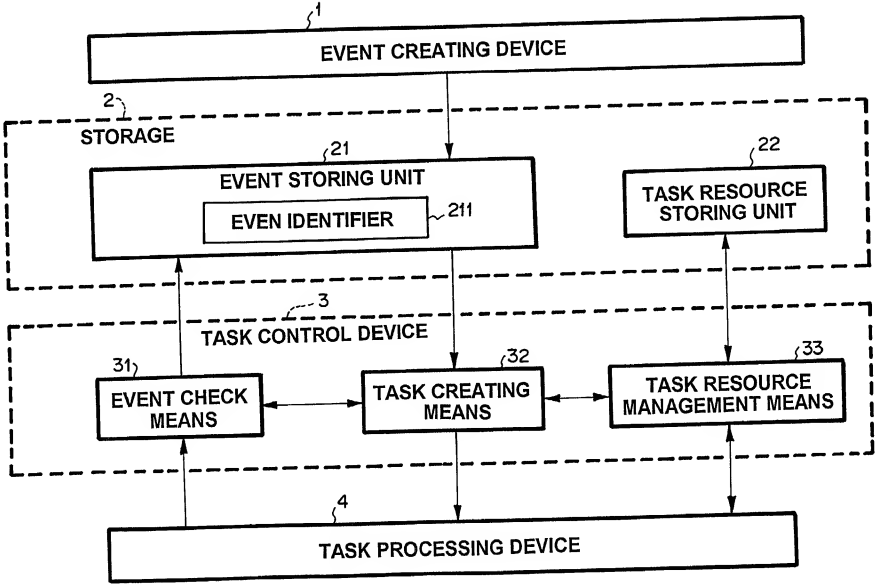


FIG.2

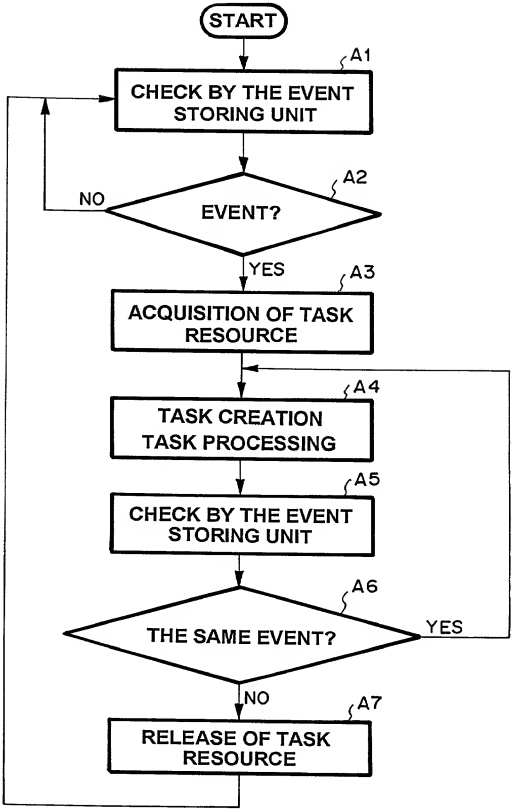

START
A1
CHECK BY THE EVENT STORING UNIT
A2
NO
EVENT?
YES
A3
ACQUISITION OF TASK RESOURCE
A4
TASK CREATION TASK PROCESSING
A5
CHECK BY THE EVENT STORING UNIT
A6
THE SAME EVENT?
YES
NO
A7
RELEASE OF TASK RESOURCE

FIG.3

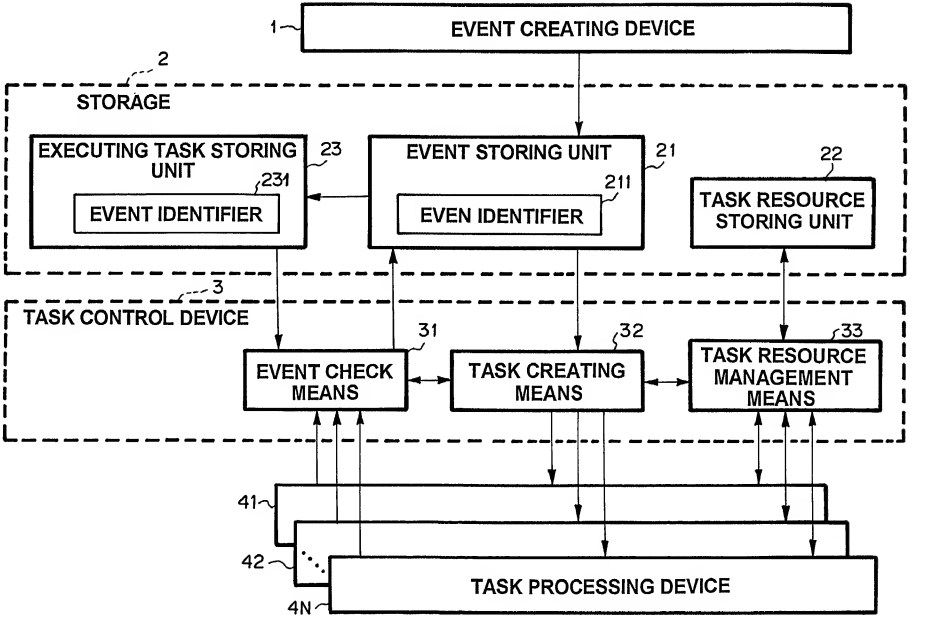


FIG.4

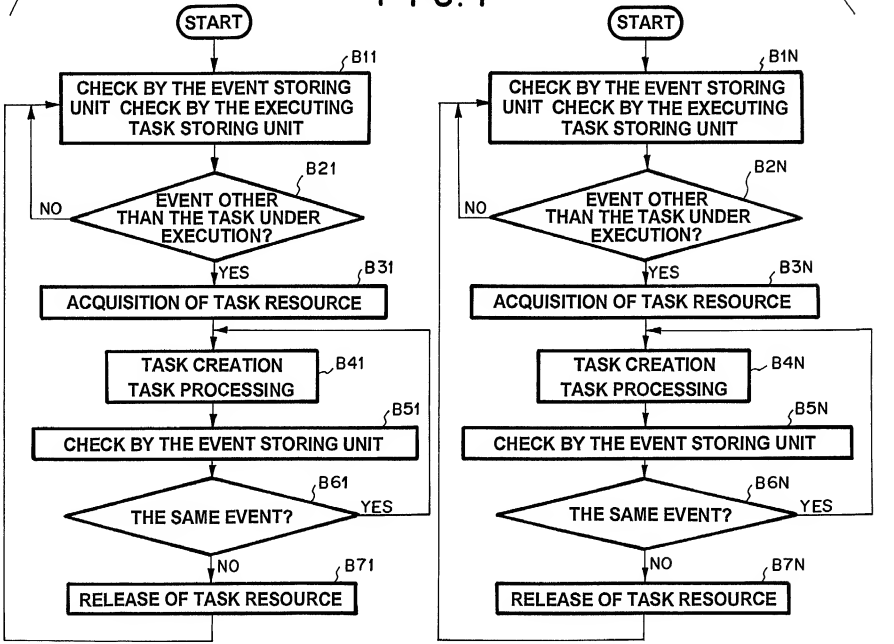
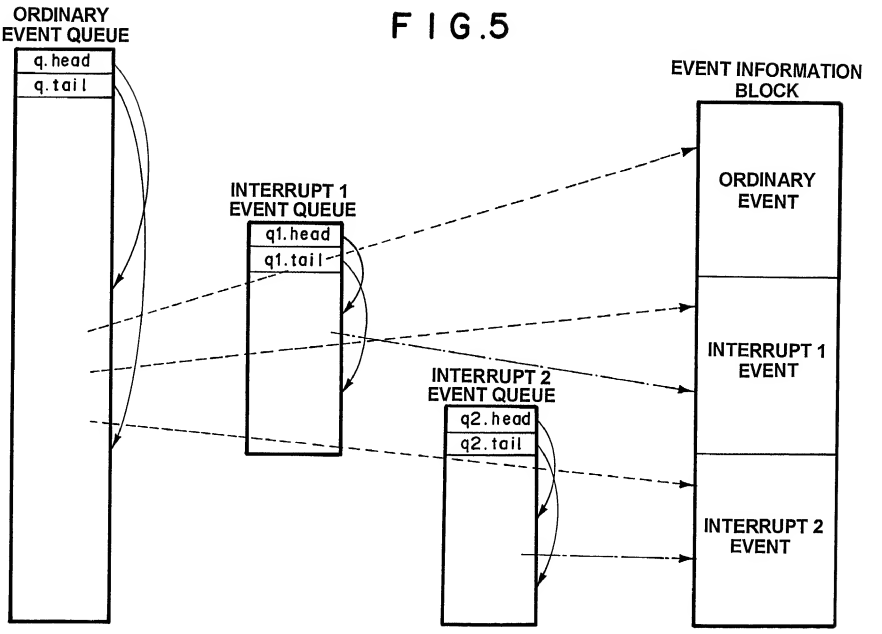


FIG.5



F-10190

Application for United States Patent

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TASK PROCESSING SYSTEM

the specification of which:
(check one)

X (is attached hereto)
___ was filed on _____
as Application Serial No. _____
and was amended on _____. (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56*

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			priority claimed	
162702/1999	Japan	09/06/1999	X	
(Number)	(Country)	(Day/Month/Year Filed)	yes	no
(Number)	(Country)	(Day/Month/Year Filed)	yes	no
(Number)	(Country)	(Day/Month/Year Filed)	yes	no

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)

Power of Attorney: As a named inventor, I hereby appoint Sean M. McGinn, Reg. No. 34, 386, and Frederick W. Gibb, III, Reg. No. 37,629, as attorneys and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. All correspondence should be directed to **McGinn & Gibb, P.C., 1701 Clarendon Boulevard, Suite 100, Arlington, Virginia 22209.** Telephone calls should be directed to McGinn & Gibb, P.C. at (703) 294-6699.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Inventor's Signature Shusaku Uchibori Date May 16, 2000

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Joint Inventor, If Any _____

Inventor's Signature _____ Date _____

Residence _____

Citizenship _____

Post Office Address _____

Full Name of Third
Joint Inventor, If Any _____

Inventor's Signature _____ Date _____

Residence _____

Citizenship _____

Post Office Address _____

Full Name of Fourth
Joint Inventor, If Any _____

Inventor's Signature _____ Date _____

Residence _____

Citizenship _____

Post Office Address _____

(An additional sheet(s) is/are attached hereto if the present invention includes more than four inventors.)

*Title 37, Code of Federal Regulations, § 1.56:

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith toward the Patent and Trademark Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and (1) it establishes by itself or in combination with other information, a prima facie case of unpatentability; or (2) it refutes, or is inconsistent with, a position the applicant takes in: (i) opposing an argument of unpatentability relied on by the Office, or (ii) asserting an argument of patentability.